
*Proposed Resource Management Plan and
Final Environmental Impact Statement*

Bighorn Basin Resource Management Plan Revision Project

Appendix Q

Economic Impact Analysis Methodology

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APPENDIX Q

ECONOMIC IMPACT ANALYSIS METHODOLOGY

1.0 INTRODUCTION

This appendix describes the methods and data that underlie the economic impact modeling analysis. Input-output models such as the Impact Analysis for Planning (IMPLAN) model, an economic impact analysis model, provide a quantitative representation of the production relationships between individual economic sectors. Thus, the economic modeling analysis uses information about physical production quantities and the prices and costs for goods and services. The inputs required to run the IMPLAN model are described in the following narrative and tables. The resulting estimates from the IMPLAN model, by alternative, can be found in the *Economic Conditions* section in Chapter 4. The first section of this appendix describes general aspects of the IMPLAN model and how it was used to estimate economic impacts. The remaining sections provide additional detailed data used in the analysis for oil and gas, livestock grazing, and recreation.

2.0 THE IMPLAN MODEL

IMPLAN is a regional economic model that provides a mathematical accounting of the flow of money, goods, and services through a region's economy. The model provides estimates of how a specific economic activity translates into jobs and income for the region. It includes the ripple effect (also called the "multiplier effect") of changes in economic sectors that may not be directly impacted by management actions, but are linked to industries that are directly impacted. In IMPLAN, these ripple effects are termed indirect impacts (for changes in industries that sell inputs to the industries that are directly impacted) and induced impacts (for changes in household spending as household income increases or decreases due to the changes in production).

This analysis used IMPLAN 2007; prior to running the model, cost and price data were converted to a consistent dollar year (2011) using regional and sector-specific adjustment factors from the IMPLAN model. The values in this appendix are expressed in year 2011 dollars so that the earnings and employment estimates can be easily compared to the latest (i.e., 2011) earnings and employment data available from the Bureau of Economic Analysis.

The IMPLAN model has 440 economic sectors, of which 188 are represented in the four Planning Area counties. This analysis involved direct changes in economic activity for 33 IMPLAN economic sectors, as well as changes in all other related sectors due to the ripple effect. The IMPLAN production coefficients were modified to reflect the interaction of producing sectors in the Planning Area. As a result, the calibrated model does a better job of generating multipliers and the subsequent impacts that reflect the interaction between and among the sectors in the Planning Area compared to a model using unadjusted national coefficients. For instance, worker productivity in oil and gas production is higher in Wyoming than the national average. Key variables used in the IMPLAN model were filled in using data specific to Wyoming, including employment estimates, labor earnings, and total industry output.

3.0 OIL AND GAS

The economic impacts analysis for oil and gas reflects drilling, completion, and production activities. The number of wells drilled and completed is based on the updated Reasonable Foreseeable Development (RFD) scenario (BLM 2009a; BLM 2014a) and the constraints applied under each alternative. Total well numbers for each alternative are presented in Table Q-1. Table Q-2 presents the projected quantity of oil and gas produced on federal surface, and Table Q-3 presents the projected quantity of oil and gas produced from federal, state, and private (fee) surface.

Table Q-1. Oil and Gas Well Numbers

| Item | Conventional Infill | Exploratory Deep | Coalbed Natural Gas | Total |
|---|---------------------|------------------|---------------------|-------|
| <i>Federal Surface</i> | | | | |
| Alternative A – Wells Drilled | 989 | 112 | 83 | 1,184 |
| Alternative A – Wells Completed | 854 | 32 | 75 | 961 |
| Alternative B – Wells Drilled | 396 | 45 | 16 | 457 |
| Alternative B – Wells Completed | 344 | 13 | 15 | 372 |
| Alternative C – Wells Drilled | 1,082 | 123 | 99 | 1,304 |
| Alternative C – Wells Completed | 934 | 36 | 90 | 1,060 |
| Alternative D – Wells Drilled | 954 | 108 | 79 | 1,141 |
| Alternative D – Wells Completed | 824 | 31 | 71 | 926 |
| Alternative E – Wells Drilled | 396 | 44 | 14 | 454 |
| Alternative E – Wells Completed | 344 | 13 | 13 | 370 |
| Alternative F – Wells Drilled | 955 | 107 | 79 | 1,141 |
| Alternative F – Wells Completed | 825 | 31 | 72 | 928 |
| <i>Federal, State, and Fee Surface</i> | | | | |
| Alternative A – Wells Drilled | 1,407 | 160 | 128 | 1,695 |
| Alternative A – Wells Completed | 1,210 | 46 | 115 | 1,371 |
| Alternative B – Wells Drilled | 814 | 93 | 61 | 968 |
| Alternative B – Wells Completed | 700 | 27 | 55 | 782 |
| Alternative C – Wells Drilled | 1,500 | 171 | 144 | 1,815 |
| Alternative C – Wells Completed | 1,290 | 50 | 130 | 1,470 |
| Alternative D – Wells Drilled | 1,372 | 156 | 124 | 1,652 |
| Alternative D – Wells Completed | 1,180 | 45 | 111 | 1,336 |
| Alternative E – Wells Drilled | 814 | 92 | 59 | 965 |
| Alternative E – Wells Completed | 700 | 27 | 53 | 780 |
| Alternative F – Wells Drilled | 1,373 | 155 | 124 | 1,652 |
| Alternative F – Wells Completed | 1,181 | 45 | 112 | 1,338 |

Sources: BLM 2009a; BLM 2009b; BLM 2013; BLM 2014a

Table Q-2. Projected Oil and Gas Production (Federal Surface)

| Year | Alternative A | | Alternative B | | Alternative C | | Alternative D | | Alternative E | | Alternative F | |
|------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | Gas (BCF) | Oil (MMBO) |
| 2009 | 12.1 | 7.3 | 4.9 | 2.9 | 13.3 | 8.0 | 11.7 | 7.0 | 4.8 | 2.9 | 11.7 | 7.0 |
| 2010 | 11.8 | 6.9 | 4.7 | 2.8 | 12.9 | 7.6 | 11.4 | 6.7 | 4.7 | 2.8 | 11.4 | 6.7 |
| 2011 | 11.4 | 6.6 | 4.6 | 2.6 | 12.5 | 7.2 | 11.0 | 6.3 | 4.6 | 2.6 | 11.0 | 6.3 |
| 2012 | 11.1 | 6.2 | 4.4 | 2.5 | 12.2 | 6.8 | 10.7 | 6.0 | 4.4 | 2.5 | 10.7 | 6.0 |
| 2013 | 10.8 | 5.9 | 4.3 | 2.4 | 11.8 | 6.5 | 10.4 | 5.7 | 4.3 | 2.4 | 10.4 | 5.7 |
| 2014 | 10.5 | 5.6 | 4.2 | 2.3 | 11.5 | 6.2 | 10.1 | 5.4 | 4.2 | 2.2 | 10.1 | 5.4 |
| 2015 | 10.2 | 5.3 | 4.1 | 2.1 | 11.1 | 5.8 | 9.8 | 5.2 | 4.1 | 2.1 | 9.8 | 5.2 |
| 2016 | 9.9 | 5.1 | 4.0 | 2.0 | 10.8 | 5.6 | 9.5 | 4.9 | 3.9 | 2.0 | 9.5 | 4.9 |
| 2017 | 9.6 | 4.8 | 3.8 | 1.9 | 10.5 | 5.3 | 9.3 | 4.7 | 3.8 | 1.9 | 9.3 | 4.7 |
| 2018 | 9.3 | 4.6 | 3.7 | 1.8 | 10.2 | 5.0 | 9.0 | 4.4 | 3.7 | 1.8 | 9.0 | 4.4 |
| 2019 | 9.1 | 4.4 | 3.6 | 1.7 | 9.9 | 4.8 | 8.7 | 4.2 | 3.6 | 1.7 | 8.7 | 4.2 |
| 2020 | 8.8 | 4.1 | 3.5 | 1.7 | 9.6 | 4.5 | 8.5 | 4.0 | 3.5 | 1.7 | 8.5 | 4.0 |
| 2021 | 8.5 | 3.9 | 3.4 | 1.6 | 9.3 | 4.3 | 8.2 | 3.8 | 3.4 | 1.6 | 8.2 | 3.8 |
| 2022 | 8.3 | 3.7 | 3.3 | 1.5 | 9.1 | 4.1 | 8.0 | 3.6 | 3.3 | 1.5 | 8.0 | 3.6 |
| 2023 | 8.1 | 3.5 | 3.2 | 1.4 | 8.8 | 3.9 | 7.8 | 3.4 | 3.2 | 1.4 | 7.8 | 3.4 |
| 2024 | 7.8 | 3.4 | 3.1 | 1.3 | 8.6 | 3.7 | 7.5 | 3.2 | 3.1 | 1.3 | 7.5 | 3.2 |
| 2025 | 7.6 | 3.2 | 3.0 | 1.3 | 8.3 | 3.5 | 7.3 | 3.1 | 3.0 | 1.3 | 7.3 | 3.1 |
| 2026 | 7.4 | 3.0 | 3.0 | 1.2 | 8.1 | 3.3 | 7.1 | 2.9 | 2.9 | 1.2 | 7.1 | 2.9 |
| 2027 | 7.2 | 2.9 | 2.9 | 1.2 | 7.8 | 3.2 | 6.9 | 2.8 | 2.9 | 1.2 | 6.9 | 2.8 |
| 2028 | 7.0 | 2.7 | 2.8 | 1.1 | 7.6 | 3.0 | 6.7 | 2.6 | 2.8 | 1.1 | 6.7 | 2.6 |

Sources: BLM 2009a; BLM 2009b; BLM 2013; BLM 2014a

BCF billion cubic feet
 MMBO million barrels of oil

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Table Q-3. Projected Oil and Gas Production (Federal, State, and Fee Surface)

| Year | Alternative A | | Alternative B | | Alternative C | | Alternative D | | Alternative E | | Alternative F | |
|------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | Gas (BCF) | Oil (MMBO) |
| 2009 | 17.3 | 10.4 | 10.0 | 6.0 | 18.4 | 11.1 | 16.8 | 10.1 | 10.0 | 6.0 | 16.8 | 10.1 |
| 2010 | 16.8 | 9.9 | 9.7 | 5.7 | 17.9 | 10.5 | 16.3 | 9.6 | 9.7 | 5.7 | 16.3 | 9.6 |
| 2011 | 16.3 | 9.4 | 9.4 | 5.4 | 17.4 | 10.0 | 15.9 | 9.1 | 9.4 | 5.4 | 15.9 | 9.1 |
| 2012 | 15.8 | 8.9 | 9.2 | 5.1 | 16.9 | 9.5 | 15.4 | 8.7 | 9.1 | 5.1 | 15.4 | 8.7 |
| 2013 | 15.4 | 8.4 | 8.9 | 4.9 | 16.4 | 9.0 | 15.0 | 8.2 | 8.9 | 4.9 | 15.0 | 8.2 |
| 2014 | 14.9 | 8.0 | 8.6 | 4.6 | 15.9 | 8.5 | 14.5 | 7.8 | 8.6 | 4.6 | 14.5 | 7.8 |
| 2015 | 14.5 | 7.6 | 8.4 | 4.4 | 15.4 | 8.1 | 14.1 | 7.4 | 8.4 | 4.4 | 14.1 | 7.4 |
| 2016 | 14.1 | 7.2 | 8.1 | 4.2 | 15.0 | 7.7 | 13.7 | 7.1 | 8.1 | 4.2 | 13.7 | 7.0 |
| 2017 | 13.7 | 6.9 | 7.9 | 4.0 | 14.6 | 7.3 | 13.3 | 6.7 | 7.9 | 4.0 | 13.3 | 6.7 |
| 2018 | 13.3 | 6.5 | 7.7 | 3.8 | 14.1 | 7.0 | 12.9 | 6.4 | 7.7 | 3.8 | 12.9 | 6.4 |
| 2019 | 12.9 | 6.2 | 7.5 | 3.6 | 13.7 | 6.6 | 12.6 | 6.0 | 7.5 | 3.6 | 12.6 | 6.0 |
| 2020 | 12.5 | 5.9 | 7.2 | 3.4 | 13.3 | 6.3 | 12.2 | 5.7 | 7.2 | 3.4 | 12.2 | 5.7 |
| 2021 | 12.2 | 5.6 | 7.0 | 3.2 | 13.0 | 6.0 | 11.9 | 5.4 | 7.0 | 3.2 | 11.9 | 5.4 |
| 2022 | 11.8 | 5.3 | 6.8 | 3.1 | 12.6 | 5.7 | 11.5 | 5.2 | 6.8 | 3.1 | 11.5 | 5.2 |
| 2023 | 11.5 | 5.0 | 6.6 | 2.9 | 12.2 | 5.4 | 11.2 | 4.9 | 6.6 | 2.9 | 11.2 | 4.9 |
| 2024 | 11.1 | 4.8 | 6.4 | 2.8 | 11.9 | 5.1 | 10.9 | 4.7 | 6.4 | 2.8 | 10.9 | 4.7 |
| 2025 | 10.8 | 4.5 | 6.3 | 2.6 | 11.5 | 4.8 | 10.5 | 4.4 | 6.3 | 2.6 | 10.5 | 4.4 |
| 2026 | 10.5 | 4.3 | 6.1 | 2.5 | 11.2 | 4.6 | 10.2 | 4.2 | 6.1 | 2.5 | 10.2 | 4.2 |
| 2027 | 10.2 | 4.1 | 5.9 | 2.4 | 10.9 | 4.4 | 9.9 | 4.0 | 5.9 | 2.4 | 9.9 | 4.0 |
| 2028 | 9.9 | 3.9 | 5.7 | 2.3 | 10.6 | 4.2 | 9.7 | 3.8 | 5.7 | 2.3 | 9.7 | 3.8 |

Sources: BLM 2009a; BLM 2009b; BLM 2013; BLM 2014a

BCF billion cubic feet

MMBO million barrels of oil

The costs of drilling and completing wells and producing oil and gas, also are relevant for the economic impact analysis. Table Q-4 provides a summary of the costs of drilling, completion, and production for each well type (conventional infill, exploratory deep, and coalbed natural gas [CBNG]) used for the economic analysis.

Table Q-4. Assumptions for Analysis of Economic Impacts for Oil and Gas Well Drilling and Completion According to Well Type

| Assumption | Well Type | | |
|---|---------------------|------------------|---------------------|
| | Conventional Infill | Exploratory Deep | Coalbed Natural Gas |
| Drilling Impacts | | | |
| Drilling Cost (\$/well) | \$960,017 | \$9,372,267 | \$48,641 |
| Local Drilling Costs ¹ | 85% | 58% | 83% |
| Local Direct Impact (\$/well) | \$812,044 | \$5,476,054 | \$40,594 |
| Local Total Impact (\$/well) ² | \$1,079,243 | \$6,991,360 | \$53,927 |
| Multiplier (total impact/direct impact) | 1.33 | 1.28 | 1.33 |
| Completion Impacts | | | |
| Completion Cost (\$/well) | \$1,376,005 | \$4,338,189 | \$51,323 |
| Local Completion Costs ¹ | 55% | 37% | 55% |
| Local Direct Impact (\$/well) | \$762,734 | \$1,614,992 | \$28,449 |
| Local Total Impact (\$/well) ² | \$1,011,420 | \$2,054,612 | \$39,957 |
| Multiplier (total impact/direct impact) | 1.33 | 1.27 | 1.40 |

Source: BLM 2009b; adjusted to year 2011 dollars using chain-type price indices from IMPLAN (Taylor 2010) and the Consumer Price Index (BLS 2014). Data are based on Authorizations For Expenditure provided by exploration and development companies, and include the assumption that approximately 40 percent of infill and deep wells will be directional or horizontal and the remainder will be vertical.

¹The local cost shares were based on the percent of total drilling or completion costs that would be spent on goods and services purchased from the local economy.

²Total impacts estimated using Impact Analysis for Planning (IMPLAN) include direct, indirect, and induced impacts.

% percent
\$ U.S. dollars

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Table Q-5 provides the assumptions used to determine the economic impact associated with the production of oil and gas. For the analysis, the Bureau of Land Management (BLM) estimated a production cost (for gas) of \$1.55 per thousand cubic feet (mcf), based on data from the Energy Information Administration (Taylor 2010) and updated to year 2011 dollars using the Consumer Price Index (BLS 2014).

Table Q-5. Assumptions for Analysis of Economic Impacts on Output for Oil and Gas Production

| Economic Impact | Oil Production (per million barrels) | Gas Production (per billion cubic feet) |
|---|---|--|
| Direct Economic Impact ¹ | \$84,006,000 ² | \$4,345,000 ³ |
| Indirect Economic Impact ⁴ | \$4,833,957 | \$250,024 |
| Induced Economic Impact ⁵ | \$2,166,767 | \$112,071 |
| Total Economic Impact | \$91,006,724 | \$4,707,095 |
| Multiplier (total impact/direct impact) | 1.08 | 1.08 |

Note: All dollar values are in year 2011 dollars.

¹Direct economic impact is the market value of output.

²Based on an oil price of \$84.006 per barrel, which is the forecast price for oil from 2015-2018 projected by the Wyoming Consensus Revenue Estimating Group (CREG 2013), adjusted from \$87.00 (in 2013 dollars) to 2011 dollars.

³Based on a gas price of \$4.345 per thousand cubic feet; this is the price forecast for gas from 2016 (\$4.50 per mcf) projected by the Wyoming Consensus Revenue Estimating Group (CREG 2013), adjusted from 2013 to 2011 dollars. The 2016 forecast price was used because it is representative of the forecast range (\$3.85-\$4.95 per mcf) over 2014-2018.

⁴Indirect impacts from Impact Analysis for Planning (IMPLAN) reflect increased demand in sectors that directly or indirectly provide supplies to the oil and gas industry.

⁵Induced impacts from IMPLAN reflect increased demand in the consumer and government sectors.

The forecasted number of wells and production used for estimating employment impacts is the same as for estimating impacts on labor earnings and output. Table Q-6 shows the direct and total employment impacts attributable to drilling and completion.

Table Q-6. Assumptions for Employment Impact Analysis for Oil and Gas Well Drilling and Completion According to Well Type

| Employment Impact | Well Type | | |
|---|---------------------|------------------|---------------------|
| | Conventional Infill | Exploratory Deep | Coalbed Natural Gas |
| Drilling Impacts | | | |
| Direct Employment (jobs/well) | 3.4 | 20.7 | 0.2 |
| Total Employment Impact (jobs/well) | 5.8 | 34.5 | 0.3 |
| Multiplier (Total Impact/Direct Impact) | 1.69 | 1.67 | 1.70 |
| Average Earnings per Job (2011 dollars) | \$64,779 | \$63,453 | \$54,795 |
| Completion Impacts | | | |
| Direct Employment (jobs/well) | 4.1 | 7.1 | 0.2 |
| Total Employment Impact (jobs/well) | 6.5 | 11.2 | 0.3 |
| Multiplier (Total Impact/Direct Impact) | 1.59 | 1.58 | 1.58 |
| Average Earnings per Job (2011 dollars) | \$59,699 | \$60,374 | \$58,360 |

Note: Direct and total employment impact and average earnings per job are calculated using Impact Analysis for Planning (IMPLAN).

Table Q-7 shows the direct and total employment impacts associated with production.

Table Q-7. Assumptions for Employment Impact Analysis for Oil and Gas Production

| Employment Impact (annual number of jobs) | Oil Production (per million barrels) | Gas Production (per billion cubic feet) |
|--|---|--|
| Direct Employment | 26.9 | 1.7 |
| Indirect Employment | 30.6 | 1.9 |
| Induced Employment | 18.7 | 1.2 |
| Total Employment | 76.2 | 4.8 |
| Multiplier (Total Impact/Direct Impact) | 2.83 | 2.83 |
| Average Earnings per Job (2011 dollars) | \$60,779 | \$74,439 |

Note: Direct, indirect, and induced employment impact and average earnings per job are calculated using Impact Analysis for Planning (IMPLAN).

The analysis of potential changes in tax revenues is based on tax rates of 12.5 percent of taxable value for federal mineral royalties, 6 percent of taxable value for state severance taxes (Wyoming Department of Revenue 2001), and 6.8 percent of taxable value for local ad valorem production taxes (based on average tax rates for the counties of Big Horn [7.2%], Hot Springs [6.3%], Park [7.0%], and Washakie [6.9%]) (Wyoming Department of Revenue 2014). Taxable value refers to value of sales minus allowable deductions, including certain costs of production and transportation. For purposes of estimating tax revenues, taxable value was estimated based on the average taxable value per unit sold from the counties in the Planning Area for production year 2010 using data from the Wyoming Department of Revenue (Wyoming Department of Revenue 2011). Taxable value was estimated as \$63.01 per barrel for oil, and \$3.40 per mcf for natural gas (2011 dollars).

4.0 LIVESTOCK GRAZING

Economic impacts due to changes in livestock grazing are a function of the amount of forage available and the economic value of the forage. For livestock grazing, long-term surface-disturbing actions from actions listed in Appendix T may affect available animal unit months (AUMs). BLM actions to withdraw certain lands for livestock grazing would also reduce the available forage on federal lands. In addition, land disposal actions may have economic impacts; however, those impacts were not analyzed quantitatively because it is difficult to predict the net change in AUMs. Subsequent landowners may continue to graze the land, leaving overall livestock production and output in the region unaffected.

The economic analysis of livestock grazing impacts is based on a long-term average (from 1988 to 2012) of authorized use as a proportion of active use. Based on data from the BLM's Rangeland Administration System (RAS), authorized use ranged from 43 percent to 79 percent of active use between 1988 and 2012, with an average value of 64 percent (BLM 2010a; BLM 2014b). Whereas permitted AUMs include active and suspended non-use AUMs, active use AUMs exclude suspended non-use AUMs. Authorized use represents AUMs billed for and paid for each year for a permit/lease. These AUMs are not the same as actual use AUMs (and may or may not be reasonably close to actual use AUMs), but are closer to what takes place on the ground each year, or the “actual use”, than the active use AUMs. Authorized use information is obtained from the RAS, while actual use represents the AUMs physically used on the ground. Actual use may be less than or equal to authorized use, but authorized use provides an upper bound for actual use. The BLM adjusts authorized use on an annual basis to account for the forage value

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of the land in a given year, based on climatic conditions (e.g., drought), as well as taking into account the needs of the land and the ranch operators.

Whereas reductions in land available for livestock grazing (via long-term surface disturbance or grazing withdrawal) are based on active use AUMs, financial conditions on a given ranch operation are determined by actual use (i.e., the actual forage value of the land that is used for livestock) and authorized use (e.g., bank loans that are based on the available forage value of federal leases held by the ranch operator). Thus, authorized use is a more appropriate baseline than active use from which to measure reductions in available AUMs due to surface disturbance or restriction on grazing land. If reductions were measured from a baseline of active use, with no adjustment for actual use, economic impacts would be overstated (BLM 2010a).

Based on the historical analysis from 1988 to 2012 noted above, the economic analysis of livestock grazing impacts uses a baseline of 195,369 AUMs, which represents 64 percent of the active use of 305,264 AUMs. Reductions in AUMs due to long-term surface disturbance and grazing restrictions are also adjusted for the ratio of authorized to active use.

Table Q-8 provides a summary of initial AUMs and total AUMs lost by 2027 due to surface-disturbing activities. Based on current allocations of AUMs to cattle and sheep, 85 percent of the AUM reduction is allocated to cattle and the remainder is allocated to sheep, for the purpose of estimating changes in output and employment. (There are also some AUMs allocated to horse and buffalo grazing, but these comprise one percent and less than one percent, respectively.) Surface disturbance acres were converted to AUMs using a conversion factor of 10.5 acres per AUM (BLM 2009c).

Table Q-8. Estimated Animal Unit Month Losses

| Item | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F |
|---|---------------|---------------|---------------|---------------|---------------|---------------|
| Active Use AUMs | | | | | | |
| Initial AUMs (active use) | 305,264 | 305,264 | 305,264 | 305,264 | 305,264 | 305,264 |
| AUMs lost from surface-disturbing activities (total, long-term disturbance) | 1,490 | 1,037 | 3,951 | 1,743 | 1,029 | 1,682 |
| AUMs closed to grazing by BLM management actions | 169 | 162,572 | 169 | 169 | 162,572 | 169 |
| Total AUMs lost from surface-disturbing activities and withdrawn | 1,659 | 163,609 | 4,120 | 1,912 | 163,601 | 1,851 |
| AUMs lost from surface-disturbing activities and withdrawn (estimated annual) | 83 | 8,180 | 206 | 96 | 8,180 | 93 |
| Net AUMs in 2027 (active use) | 303,605 | 141,655 | 301,144 | 303,352 | 141,663 | 303,413 |

Table Q-8. Estimated Animal Unit Month Losses (Continued)

| Item | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F |
|---|---------------|---------------|---------------|---------------|---------------|---------------|
| AUMs Authorized (64 percent of active use AUMs) | | | | | | |
| Initial AUMs (authorized) | 195,369 | 195,369 | 195,369 | 195,369 | 195,369 | 195,369 |
| AUMs lost from surface-disturbing activities (total, long-term disturbance) | 954 | 664 | 2,529 | 1,116 | 659 | 1,076 |
| AUMs closed to grazing by BLM management actions | 108 | 104,046 | 108 | 108 | 104,046 | 108 |
| Total AUMs lost from surface-disturbing activities and withdrawn | 1,062 | 104,710 | 2,637 | 1,224 | 104,705 | 1,185 |
| AUMs lost from surface-disturbing activities and withdrawn (estimated annual) | 53 | 5,235 | 132 | 61 | 5,235 | 59 |
| Net AUMs in 2027 (authorized) | 194,307 | 90,659 | 192,732 | 194,145 | 90,664 | 194,184 |

Sources: BLM 2009c; BLM 2014b

AUM Animal Unit Month
BLM Bureau of Land Management

Due to price fluctuations, average per-AUM values for cattle and sheep are based on a ten-year average value of production estimates from the Wyoming Agricultural Statistics Service, adjusted to year 2011 dollars (Taylor 2009; Taylor 2010; BLS 2014). The value for cattle is \$48.38 per AUM and the value for sheep is \$46.84 per AUM (in 2011 dollars). Including indirect and induced impacts, the value of one AUM for cattle is \$99.95 and for sheep \$109.67 (in 2011 dollars). Table Q-9 shows the economic impact assumptions for cattle and sheep. The direct economic impact is the estimated change in livestock output per AUM; IMPLAN generates the indirect and induced impacts.

Table Q-9. Assumptions for Analysis of Impacts on Output for Livestock Grazing

| Economic Impact | Cattle | Sheep |
|--|---------|----------|
| Direct Economic Impact (\$/AUM) | \$48.38 | \$46.84 |
| Indirect Economic Impact (\$/AUM) ¹ | \$39.55 | \$47.06 |
| Induced Economic Impact (\$/AUM) ² | \$12.02 | \$15.78 |
| Total Economic Impact (\$/AUM) | \$99.95 | \$109.67 |
| Multiplier (Total Impact/Direct Impact) | 2.07 | 2.34 |

Note: All dollar values are in year 2011 dollars.

Note: Detail may not add to total due to rounding.

¹Indirect impacts reflect increased demand in sectors that directly or indirectly provide supplies to the livestock industry.

²Induced impacts reflect increased demand in the consumer and government sectors.

AUM Animal Unit Month

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Table Q-10 provides a summary of the employment impacts assumed according to unit changes in livestock AUMs.

Table Q-10. Assumptions for Analysis of Employment Impacts for Livestock Grazing

| Employment Impact | Cattle | Sheep |
|--|----------|----------|
| Direct Employment (Jobs/1,000 AUMs) | 0.466 | 0.980 |
| Indirect Employment (Jobs/1,000 AUMs) | 0.233 | 0.542 |
| Induced Employment (Jobs/1,000 AUMs) | 0.121 | 0.165 |
| Total Employment (Jobs/1,000 AUMs) | 0.820 | 1.687 |
| Multiplier (Total Impact/Direct Impact) | 1.76 | 1.72 |
| Average Earnings per Job (year 2011 dollars) | \$36,126 | \$19,940 |

Note: Direct, indirect, and induced employment impacts and average earnings per job are calculated using Impact Analysis for Planning (IMPLAN).

AUM Animal Unit Month

5.0 RECREATION

The analysis of economic impacts considers only recreation expenditures of nonresidents of the Planning Area. This is based on the assumption that expenditures of residents would occur in the region regardless of the BLM's actions that impact recreational opportunities; however, changes in nonresident recreation patterns would alter the amount of money entering the local region.

Economic impacts from recreation are a function of recreation visitor days (RVDs) and expenditures per day. Future RVDs were estimated based on current RVDs, recent growth rates, and projected trends. Estimates of future RVDs were based on the professional judgment of BLM staff, as well as a United States Forest Service (USFS) study that provides forecasts of recreation activity for the Rocky Mountain region (Bowker et al. 1999) and contacts with neighboring BLM field offices. Table Q-11 provides a summary of estimated annual growth rates, and Figure Q-1 provides a graphical view.

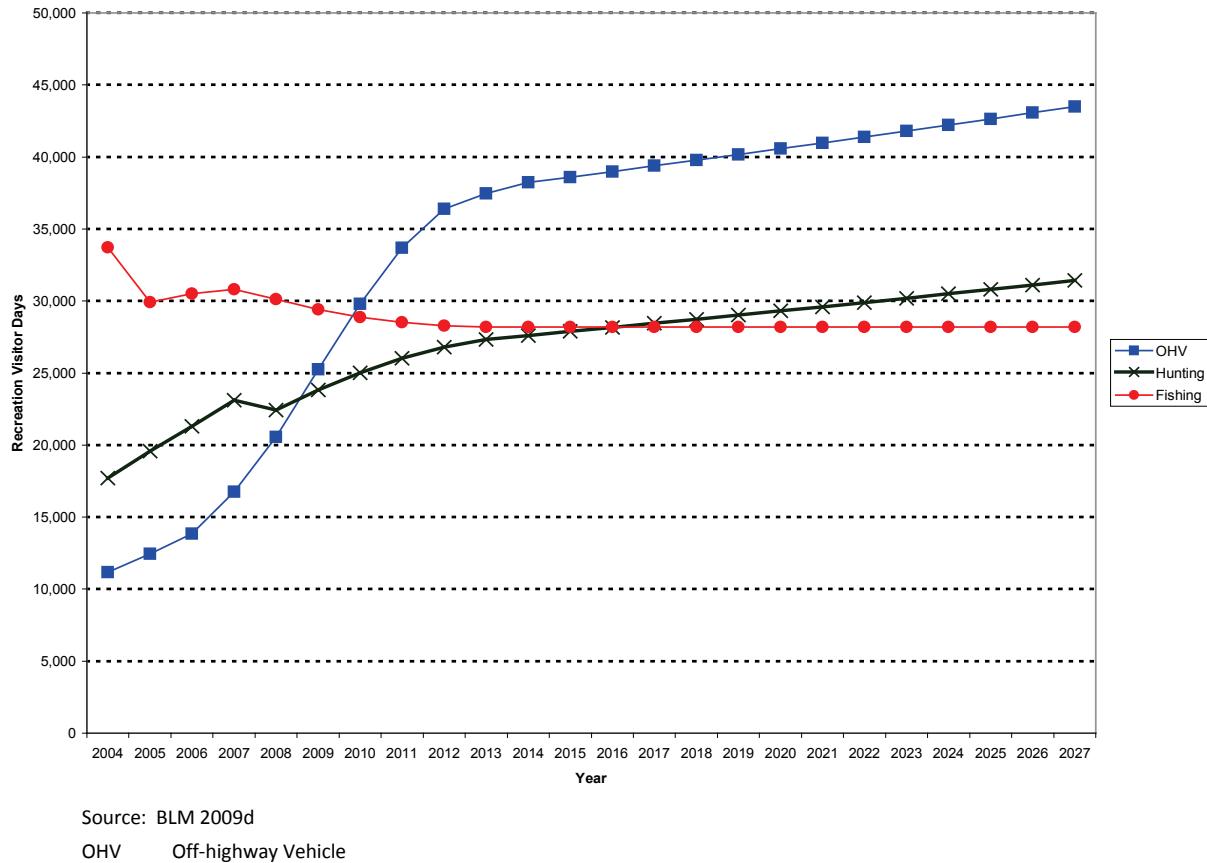
Table Q-11. Estimated Growth Rates for Nonresident Recreation Visitor Days

| Year | OHV | | Hunting | | Fishing | |
|------|-------------------|------------------------------|-------------------|------------------------------|-------------------|------------------------------|
| | RVDs this year | Growth over previous year | RVDs this year | Growth over previous year | RVDs this year | Growth over previous year |
| 2004 | 11,177 | - | 17,707 | - | 33,725 | - |
| 2005 | 12,440 | 11.3% | 19,579 | 10.57% | 29,904 | -11.33% |
| 2006 | 13,846 | 11.3% | 21,288 | 8.73% | 30,523 | 2.07% |
| 2007 | 16,753 | 21.0% | 23,119 | 8.60% | 30,822 | 0.98% |
| 2008 | 20,573 | 22.8% | 22,432 | -2.97% | 30,113 | -2.30% |
| 2009 | 25,264 | 22.8% | 23,830 | 6.23% | 29,420 | -2.30% |
| 2010 | 29,811 | 18.0% | 25,021 | 5.0% | 28,891 | -1.8% |
| 2011 | 33,687 | 13.0% | 26,022 | 4.0% | 28,515 | -1.3% |
| 2012 | 36,381 | 8.0% | 26,802 | 3.0% | 28,287 | -0.8% |
| 2013 | 37,473 | 3.0% | 27,339 | 2.0% | 28,202 | -0.3% |
| 2014 | 38,222 | 2.0% | 27,612 | 1.0% | 28,202 | 0.0% |
| 2015 | 38,605 | 1.0% | 27,888 | 1.0% | 28,202 | 0.0% |
| 2016 | 38,991 | 1.0% | 28,167 | 1.0% | 28,202 | 0.0% |
| 2017 | 39,381 | 1.0% | 28,449 | 1.0% | 28,202 | 0.0% |
| 2018 | 39,774 | 1.0% | 28,733 | 1.0% | 28,202 | 0.0% |
| 2019 | 40,172 | 1.0% | 29,020 | 1.0% | 28,202 | 0.0% |
| 2020 | 40,574 | 1.0% | 29,311 | 1.0% | 28,202 | 0.0% |
| 2021 | 40,980 | 1.0% | 29,604 | 1.0% | 28,202 | 0.0% |
| 2022 | 41,389 | 1.0% | 29,900 | 1.0% | 28,202 | 0.0% |
| 2023 | 41,803 | 1.0% | 30,199 | 1.0% | 28,202 | 0.0% |
| 2024 | 42,221 | 1.0% | 30,501 | 1.0% | 28,202 | 0.0% |
| 2025 | 42,643 | 1.0% | 30,806 | 1.0% | 28,202 | 0.0% |
| 2026 | 43,070 | 1.0% | 31,114 | 1.0% | 28,202 | 0.0% |
| 2027 | 43,501 | 1.0% | 31,425 | 1.0% | 28,202 | 0.0% |

Source: BLM 2009d. Data from 2009 through 2027 are projections.

OHV Off-highway vehicle
RVD Recreation visitor day

**Figure Q-1. Recent Trends and Projected Future Change:
Nonresident Recreation Visitor Days**



The estimates for average expenditure per visitor day, in year 2011 dollars, are \$92.55 for fishing (Wyoming Game and Fish Department [WGFD] 2008; USFWS 2008); \$140.73 for hunting (Responsive Management 2004); and \$56.33 for off-highway vehicle (OHV) use (Foulke et al. 2006). Table Q-12 shows the direct, indirect, and induced output per RVD for each recreation activity, in year 2011 dollars.

Table Q-12. Assumptions for Analysis of Impacts on Output for Recreation Activities

| Economic Impact | OHV (per RVD) | Hunting (per RVD) | Fishing (per RVD) |
|---|------------------|----------------------|----------------------|
| Direct Economic Impact ¹ | \$56.33 | \$140.73 | \$92.55 |
| Indirect Economic Impact ² | \$8.30 | \$38.27 | \$12.28 |
| Induced Economic Impact ³ | \$5.94 | \$22.85 | \$10.74 |
| Total Economic Impact | \$70.57 | \$201.85 | \$115.57 |
| Multiplier (total impact/direct impact) | 1.25 | 1.43 | 1.25 |

Note: Detail may not add to total due to rounding.

¹Direct economic impact is the average expenditure per visitor day.

²Indirect impacts from Impact Analysis for Planning (IMPLAN) reflect increased demand in sectors that directly or indirectly provide support for the recreation industry.

³Induced impacts from IMPLAN reflect increased demand in the consumer and government sectors.

OHV Off-highway vehicle
RVD Recreation visitor day

Table Q-13 provides a summary of employment impacts assumed according to unit changes in RVDs.

Table Q-13. Assumptions for Employment Impact Analysis for Recreation Activities

| Employment Impact (annual number of jobs) | OHV (per 1,000 RVDs) | Hunting (per 1,000 RVDS) | Fishing (per 1,000 RVDS) |
|--|-------------------------|-----------------------------|-----------------------------|
| Direct Employment | 0.69 | 2.45 | 1.24 |
| Indirect Employment | 0.07 | 0.33 | 0.10 |
| Induced Employment | 0.06 | 0.23 | 0.11 |
| Total Employment | 0.83 | 3.01 | 1.46 |
| Multiplier (Total Impact/Direct Impact) | 1.20 | 1.23 | 1.17 |
| Average Earnings per Job (2011 dollars) | \$18,640 | \$19,741 | \$19,253 |

Note: Direct, indirect, and induced employment impact and average earnings per job are calculated using Impact Analysis for Planning (IMPLAN).

Note: Detail may not add to total due to rounding.

OHV Off-highway vehicle
RVD Recreation visitor day

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Appendix Q – Economic Impact Analysis Methodology

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